Team Boza

TOWER EDU-FENSE

Project Requirements Document

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Table of Contents

Executive Summary

TOWER EDU-FENSE is a tower defense game with heavy educational components targeted at the elementary school level. TOWER EDU-FENSE is intended to teach math, geography, and chemistry while providing a fun and rewarding experience to all players. The game will be designed to be bright and exciting while having robust gameplay design that has customizable difficulty via the game maps' designs. The software will be straightforward the targeted demographic of young children will have no challenges with using it.

This document provides nontechnical information regarding the purpose and behavior of TOWER EDU-FENSE.

Document Versioning

Date	Owner	Comment
9/2/2024	Brooktie Frogge	Template

Project Description

Team Boza's incredible idea to enter the game marketing space while tapping into basic educational fields is brought to life through TOWER EDU-FENSE. This game is intended to be a staple of the educational/game market. TOWER EDU-FENSE provides a seamless integration of tower-defense gameplay with core educational subjects such as math, geography, and chemistry, designed specifically for elementary school students to learn while having fun.

The game is engineered to be highly engaging and visually appealing, ensuring that the learning experience is fun and rewarding. With intuitive controls and an interface tailored for youngsters, TOWER EDU-FENSE allows children to play independently without parental supervision. The game's design includes customizable difficulty settings and educational content that adapts to different learning stages, enabling personalized learning paths and usage in educational environments such as school!

TOWER EDU-FENSE does not require any network connectivity, allowing it to be played anywhere at any time as long as the user has JDK installed onto their computer. Additionally, while TOWER EDU-FENSE is focused on gameplay, its backend design will support the integration of additional educational modules or features, ensuring the game remains a relevant and effective learning tool as educational standards and technologies evolve.

TOWER EDU-FENSE is distinct in its focus not only on providing entertainment but also on fostering educational growth, aiming to fill a significant gap in the current educational game market.

Features

The feature matrix enumerates the features requested for the project and the discussion section provides details regarding the intent of the feature. The ids will be used for traceability. Features that all stakeholders have agreed can be removed should strike-through the feature id and have a comment added to discuss the feature being dropped.

Priority Codes:

H - High, a must have feature for the product to be viable and must be present for launch
M - Medium, a strongly desirable feature but product could launch without
L - Low, a feature that could be dropped if needed

Feature Matrix

ID	Prio.	Feature Name	Owner	Comment	Case #
s.1	H	Compatibility with Java Platforms	Everyone		
s.2	M	Easy to use for all ages	Everyone		
s.3	L	Simple to distribute	Everyone		
ux.1	H	GUI support	Visual Design		
ux.2	M	GUI conditions	Visual Design		
ux.3	L	Error messages	Programming		
e.1	H	Fixed game loop	Game Design		
e.2	M	Level Select	Programming		
e.3	H	Enemy	Game Design		
e.4	H	Towers	Game Design		
e.5	H	Game grid	Programming		
e.6	H	Question interface	Programming		
e.7	L	In-game	Design		

		on-screen menu			
e.8	L	Waves per Level	Game Design		
e.9	L	Buttons	Programming		
e.10	L	Currency	Game Design		
e.11	L	Game Speed Button	Programming		
e.12	L	Game Completion Tracking	Programming and Visual Design		

Feature Discussion

S.1 - Compatibility with Java platforms

To support marketing and expand potential market penetration, TOWER EDU-FENSE should be able to run on any machine that has Java installed and should not require any further software installations beyond that and the executable file.
(Not sure what this would look like… any computer with java? Would it need a compiler?)

S.2 - Easy to use for all ages

As TOWER EDU-FENSE is primarily made for elementary-school children, it should be easy to use and uncomplicated to understand. No complex directions or mechanics should be utilized.

S.3 - Simple to distribute

The final executable file should be easy to install and should have an in-depth README that ensures that all users, regardless of their familiarity with technology and the game itself, can install and run the game.

UX.1 - GUI support

To create a game with youth-friendly images and GUI. It should be colorful and the pop-up screens should be organized and spaced clearly throughout the menus to avoid any confusion with how to operate the game.

UX.2 - GUI conditions

Ensure all GUI window sections are visually cohesive and can be used simultaneously.

UX.3 - Error messages

When TOWER EDU-FENSE encounters issues that make the game unable to run/load/proceed, an error message of suitable format for a player with no ability to make any changes to the game should be displayed and the game should stop.

E.1 - Fixed game loop

This requirement was introduced by development to manage scope and provide a clear vision for the implementation of the TOWER EDU-FENSE. The game will use the following loop…

1. Display the world map
    The world has 3 islands: Math, Geography, Chemistry
2. Execute the player's difficulty choice by loading the respective game map
    Difficulty is derived from the "length" of the game map's path (no questions difficulty)
    A map with a path that is a straight line would be the most extreme difficulty
3. Begin spawning enemies for wave 1/20 upon player pressing "Start Wave"
    There are a set quantity of enemies that spawn per wave, if an enemy reaches the exit the player loses and must restart
4. Add currency to the player's total upon successfully answering educational questions
    This occurs in parallel with the tower defense game, on a section of the GUI that is simultaneously on the screen
5. Place towers onto the desired location on the game grid when the player presses the tower button and has sufficient currency
    Towers cannot be placed on the enemy path
6. Display an exciting win screen upon completion of all 10 waves and update the backend database to track the completion of said island at said difficulty

E.2 - Level select

Players should be able to choose different modes (types of questions) and difficulty (map design) to curate their playing experience to their own skill and knowledge level.

E.3 - Enemy

Enemies represent the non-player-characters that are attacking your base. They have a predetermined amount of health points and speed depending on their type, and each enemy takes away 1 player life upon reaching the exit.

E.4 - Towers

Towers represent in-game characters that the user will purchase with their in-game currency levels. There will be multiple types of towers that vary based on cost and ability. More expensive towers will be more effective against the enemy.

E.5 - Game grid

The game grid is located on the center of the GUI and comprises a 25x25 set of buttons that are locations that allow for towers to be placed. The enemy's path are grid locations that do not allow for towers to be placed.

E.6 - Question interface

Educational questions are displayed on the left side of the in-game GUI and players can use their keyboard to input answers to the educational questions that are based on the island type. For example, for the geography island the player will be asked what the capital of Vermont is, and they will be expected to input "Montpelier".

E.7 - In-game on screen menu

This would represent a menu screen at the bottom of the main game window, containing the users stats such as currency levels, enemies defeated, time played, as well as a pause button and an exit to main menu button. For example, if the pause button is pressed the game will effectively pause until the user decides to resume. If the menu button is pressed, the game will pause and a pop up window will appear with a yes and no button, indicating if the user is sure they want to exit to the main menu.

E.8 - Waves per level

Tentatively, there will be 20 waves per level, with the waves getting progressively harder. Ideally, if there is enough time during development, there will be a "boss" enemy on the final wave.

E.9 - Buttons

The grid is made of "disguised" buttons. Once a tower is selected, the grid is activated and the player is able to place the tower on the grid.

E.10 - Currency

This is the money that the player will be able to use to purchase new towers. The player will also earn more currency upon successful completion questions.

E.11 - Game speed button

For usability and convenience, a button will allow the player to control the speed of the game, which would make towers fire faster as well as the enemies approach quicker (e.g. 2X speed). This is a low-priority feature as it may be extremely difficult to implement depending on how the codebase is structured while not being essential to the game's functionality.

E.12 - Game completion tracking

In order to create a sense of progression and accomplishment, players are awarded "badges" on the world map interface for each island they successfully complete at each difficulty level.

The player will also have a button on the world map that allows them to wipe their local progress.

User Stories

User stories should never be removed from the document. If stakeholders agree to remove a user story, the user story name should be changed to strike-through and a comment regarding the approval to drop the user story must be provided.

The primary users of TOWER EDU-FENSE are game players. There can be different types of players using TOWER EDU-FENSE, for example, technology novices, new gamers, and serious gamers.

Lisa, a elementary school student
Lisa is 8 years old. She loves playing games of all kinds and forms and gets super excited about tower defense games. Lisa wants to complete all the levels of the game while learning about state capitals and the multiplication table.

Max, high school student
Max is 16 years old, and he is just learning about the periodic table of elements. He wants to find a fun way to study and memorize the periodic table.

Jane, a teacher
Jane is teaching her class the multiplication table. She wants to find a medium to get more engagement from her students while being able to have them learn it in a way that is fun.

To support all these users reliably, the system needs to be flexible enough to support a range of features. This needs careful consideration of how TOWER EDU-FENSE users might use the system and TOWER EDU-FENSE can create a user-friendly and straightforward interface so its users have the best gaming experience while maintaining the educational goal for its users.

The following use cases describe goals, criteria for success, and potential extensions for failures:

Use Cases

Use Case 1

Use Case Name	Implement Factory Design Patterns for Towers, Enemies, and Levels
Summary	Implement Factory design patterns in the codebase for creating towers, enemies, and levels.
Rationale	This will make it easier to extend and create more content, allowing for future expansion if extra resources or time are available.
Users	Developers
Preconditions	Existing codebase with basic tower, enemy, and level implementations.
Course of Events	1. Developer designs the factory pattern interfaces for towers, enemies, and levels. 2. Developer implements concrete factory classes to create different types of towers, enemies, and levels. 3. Developer integrates the factory classes into the game's main engine.
Alternative Paths	Developers may choose to use an abstract factory pattern if different product families need to be created together.
Expectations	The current code structure may require significant refactoring to accommodate the factory pattern, potentially causing delays.
Postconditions	The codebase now supports the easy addition of new towers, enemies, and levels using the factory pattern.

Use Case 2

Use Case Name	Varying Levels of Difficulty or Topics
Summary	Implement varying levels of difficulty or topics within the game.
Rationale	Students can progress to more challenging content once they master

	easier topics, ensuring continuous engagement and learning.
Users	Elementary School Students
Preconditions	Basic educational content is already implemented in the game.
Course of Events	1. The game presents the student with different levels of difficulty or topics. 2. The student selects the appropriate level or topic based on their proficiency. 3. The game adjusts the content accordingly and presents educational challenges.
Alternative Paths	The game may automatically adjust the difficulty based on the student's performance.
Expectations	Students may select a level that is too difficult or too easy, leading to frustration or boredom.
Postconditions	The student is able to engage with educational content that matches their learning level.

Use Case 3

Use Case Name	Learning Through Gameplay to Unlock Towers and Upgrades
Summary	Integrate educational problem-solving as a mechanic to unlock new towers and upgrades.
Rationale	Students can progress in the game while improving their math skills, blending education with entertainment.
Users	Elementary School Students
Preconditions	The game already includes basic tower defense mechanics.
Course of Events	1. The game presents the student with math problems during gameplay. 2. The student solves these problems to unlock new towers and upgrades.

	3. The game integrates these new towers and upgrades into the gameplay.
Alternative Paths	Towers and upgrades could be unlocked through a combination of educational achievements and in-game currency.
Expectations	The educational content may be too difficult, preventing the student from progressing in the game.
Postconditions	The student improves their math skills and gains new towers and upgrades to enhance their gameplay experience.

Use Case 4

Use Case Name	Track Learning Progress Through Reports
Summary	Provide a reporting feature that tracks students' learning progress within the game.
Rationale	Parents and teachers can monitor educational development while students enjoy playing the game.
Users	- Parental Figures - Teachers
Preconditions	The game must collect data on students' progress and achievements.
Course of Events	1. The game tracks students' educational progress during gameplay. 2. The game generates reports on the student's progress. 3. Parents and teachers access these reports through a dedicated interface.
Alternative Paths	The reports could also be emailed directly to parents and teachers.
Expectations	Technical issues could prevent data from being collected or reports from being generated.
Postconditions	Parents and teachers have a clear understanding of the student's learning progress.

Use Case 5

Use Case Name	Unlock Special Towers Through History-Related Questions
Summary	Allow students to unlock special towers by answering history-related questions.
Rationale	Middle school students interested in history can learn more about historical events and figures while playing the game.
Users	Middle School Students
Preconditions	The game includes a mechanism for asking and answering questions.
Course of Events	1. The game presents history-related questions during gameplay. 2. The student answers the questions correctly. 3. The game unlocks special towers related to the historical content.
Alternative Paths	Special towers could also be unlocked through completing specific history-based levels or challenges.
Excepations	Students may find the questions too difficult, leading to frustration.
Postconditions	The student learns more about history and gains new towers to enhance their gameplay.

Use Case 6

Use Case Name	Use Game as a Learning Tool for Standardized Test Preparation
Summary	Use the game as a learning tool to help students prepare for standardized tests.
Rationale	Students can practice key concepts in an engaging and interactive way, making test preparation more enjoyable.
Users	Teachers
Preconditions	The game includes content aligned with standardized test requirements.
Course of Events	1. The teacher selects the relevant topics and difficulty levels for their class. 2. Students play the game, practicing key concepts.

	3. The game tracks students' progress and provides feedback.
Alternative Paths	The game could offer timed challenges to simulate test conditions.
Expectations	Misalignment with test content could result in ineffective preparation.
Postconditions	Students are better prepared for standardized tests, having practiced key concepts in an engaging format.

Use Case 7

Use Case Name	Learn Geography Through Tower Defense Gameplay
Summary	Incorporate geography content into the tower defense game, allowing students to learn states and capitals.
Rationale	Elementary students can reinforce their knowledge of geography while enjoying a game they already like.
Users	Elementary School Students
Preconditions	The game already includes a basic tower defense mechanism.
Course of Events	1. The game integrates geography-based questions or challenges during gameplay. 2. Students answer questions about states and capitals correctly. 3. The game rewards students with new towers, upgrades, or progress.
Alternative Paths	Geography content could be integrated as a separate game mode or level.
Expectations	Students may not find the geography content engaging, leading to disinterest.
Postconditions	Students improve their knowledge of states and capitals while progressing in the game.

Use Case 8

Use Case Name	Learn U.S. States and Capitals as an International Student

Summary	Integrate U.S. states and capitals content into the tower defense game to help international students learn U.S. geography.
Rationale	International students can gain knowledge of U.S. geography in an enjoyable and interactive way.
Users	International Students
Preconditions	The game includes basic geography content.
Course of Events	1. The game integrates U.S. states and capitals into the gameplay. 2. International students encounter and learn this content while playing. 3. The game tracks progress and adapts difficulty based on the student's learning.
Alternative Paths	The game could offer a dedicated geography tutorial for international students.
Expectations	Language barriers may affect comprehension, leading to incorrect answers.
Postconditions	International students improve their knowledge of U.S. geography while enjoying the game.

User stories: (*Copy from the previous assignment)*

1) As a developer, I want the codebase to implement Factory design patterns for towers, enemies, and levels, so that it is easy to extend and create more of the existing content if we have extra resources and/or time.

2) As an elementary school student, I want to have varying levels of difficulty or topics for what I am learning, so that once I have mastered easier topics I can progress to harder and more enriching content.

3) As an elementary school student, I want to learn/solve educational problems during gameplay to unlock new towers and upgrades, so that I can progress in the game while also improving my math skills.

4) As a parental figure or teacher, I want to track the learning progress of my students through reports provided by the game, so that I can monitor their educational development as they play the game, while they have fun doing so.

5) As a middle school student interested in history, I want to unlock special towers by answering history-related questions, so that I can learn more about historical events and figures while playing the game.

6) As a teacher preparing my class for standardized tests, I want to use this app as a learning tool, so that my students can practice key concepts while enjoying an engaging and interactive experience.

7) As an elementary student who enjoys learning geography, I want to brush up on my knowledge of the states and capitals while playing a tower defense game so that I can continue learning even in my free time.

8) As an international student who enjoys video games, I want to learn more about U.S states and capitals while playing a tower defense game so that I can learn more about US geography.